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CAPM Anomalies and the Efficiency of Stock Markets in Transition: Evidence from Bulgaria

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Abstract
This paper investigates empirically the relation between average return and beta in the Bulgarian stock market. First, using a sample of common stocks traded on the BSE-Sofia, the study examines the effects of infrequent trading on beta estimates, measured from daily, weekly and monthly return intervals. It aims to find out whether the differences in the stability of systematic risk estimates can be explained by infrequent trading. Second, the study investigates the role of beta and other commonly recognized variables (size, book-to-market equity, asset-to-market equity, asset-to-book equity and price) in explaining cross-sectional variations in average returns over the period from January 1998 to December 2002. Evidence indicates that beta, size, market and book leverages are priced, whereas significant book-to-market equity and price effects are not observed on the BSE-Sofia. These findings are in contrast to the evidence from other markets that the relation between average return and beta is flat, and size and book-to-market equity effects are significant.

JEL Classification: G12

Keywords: average return, beta, cross-sectional regression, emerging markets, market in transition.

1. Introduction

A large number of studies have been devoted to the estimation of systematic risk, i.e. beta, since the Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965) and Black (1972) was introduced for the first time. However, the empirical evidence to date on the CAPM prediction has been inconclusive. The literature on CAPM tests

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has documented at the same time a number of CAPM anomalies[1] which give cause to doubt that beta is the only relevant measure of the systematic risk.

In their seminal study Fama and French (1992) found that (a) beta does not seem to help explain the cross-section of average stock returns, i.e. the relation between beta and average return is flat, and (b) the combination of size and book-to-market equity seems to absorb the roles of leverage and earnings/price ratio in average stock returns, at least during the 1963-1990 sample period. The Fama and French (FF) results lead to a number of other investigations of the beta-expected return relationship. Within a similar two-step Fama and MacBeth (1973) procedure using U.S. stock data Davis (1994) and He and Ng (1994) both found considerable evidence to support FF results, while Kothari *et al*. (1995) find an economically and statistically significant role for beta, although there remains a statistically significant role for size in their cross-sectional regressions, with the slope coefficient estimated to be strongly negative, a result similar to the original results of FF.

Some recent studies have tended to counter the findings of Fama and French (1992). These studies suggest some support for a positive relationship between return and beta (e.g., Chan and Lakonishok, 1993, Kothari *et al*., 1995, Kim, 1995, and Jagannathan and Wang, 1996). The differences between their results and FF evidence seem to be due to the time period examined, return interval over which beta is estimated, the form in which the CAPM is estimated and statistical issues. Pettengill et al. (1995) developed a conditional relationship between return and beta which depends on whether the excess return on the market index is positive or negative. They found that in periods when the excess market return is positive (up market) there is a significant positive relationship between beta and return. In periods when the excess market return is negative (down market), there is a negative relationship between beta and return.[2] Fletcher (1997) examined the conditional relationship between beta and return proposed by Pettengill *et al*. (1995) to UK stock market and found that when monthly cross-sectional regressions of portfolio returns on beta and size are used the evidence suggests that there is no significant positive risk premium on beta. His finding is consistent with Fama and French (1992) and Jagannathan and Wang (1996) for the U.S. stock market and also with Strong and Xu (1994) on UK stock returns.

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1. The variables (other than beta) that were found to have relations with returns include primarily firm size (ME), book-to-market equity (BE/ME), financial leverage (A/ME), earnings-price (E/P) ratio, dividend yield (DY) and stock price (P) (e.g., Fama and French, 1992).
2. This is because high beta stocks are more sensitive to the negative market excess return and have a lower return than low beta stocks.

Kothari, Shanken and Sloan (KSS, 1995) found that using betas estimated from annual rather than monthly returns produces a stronger positive relation between average return and beta. They contend that the relation between average returns and BE/ME observed by Fama and French (1992) and others[3], is seriously exaggerated by survivor bias in the COMPUSTAT sample. KSS (1995) find also that size (market capitalization) adds to explanation of average return provided by beta. Variables that (unlike size) seem to be correlated with beta, such as earnings/price, cash flow/price, BE/ME and past sales growth, add even more significantly to the explanation of average return provided by beta. This finding is in line with other studies (e.g., Basu, 1983, Chan and Chen, 1991, Fama and French, 1992, 1993 and 1996, and Lakonishok *et al*., 1994).

In contrast to the extensive research in the U.S. and Japan relating the cross-sectional behavior of stock returns to market risk and firm characteristics, there has been very limited research related to the emerging markets. Chui and Wei (1998) examine the relationship between average stock return and market beta, book-to-market equity and size in five emerging markets in the Pacific-Basin region: Hong-Kong, Korea, Malaysia, Taiwan and Thailand. The results from the cross-sectional regressions show that except for Taiwan and Thailand, average excess returns in all markets are positively related to book-to-market equity and, in general, are negatively related to size. At the same time the relation between stocks returns and market beta is 'flat' for all the markets.[4]

Given the scarce evidence on CAMP anomalies based on data from emerging markets and the fact that no work of a type similar to Fama and French (1992) has been performed on transition markets, this study attempts to look into the role played by different risk factors, in addition to beta, in pricing Bulgarian equity stocks. The paper is organized as follows. In the next section the beta estimation model and the data used are described. The empirical analysis is carried out using the two-step regression technique. Then, the empirical results from the regressions are presented and discussed in breadth. In the following section the cross-sectional regressions

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3. Fama and French (1996) argue that survivor bias cannot explain the relation between average return and BE/ME. They formed 100 equal-weight portfolios on size and beta and run univariate cross-section regressions of monthly and annual portfolio returns on their betas and natural log of the average size of the stocks in each of the 100 portfolios. Confirming Banz (1981) the results reject the central CAPM hypothesis that beta suffices to explain expected return.

4. When stocks are used in the regressions, similar to the results found from using size-BE/ME portfolios, the market beta does not have any power to explain the cross-sectional variation of the stock returns. Chui and Wei (1998) use Scholes and Williams' (1977) beta, where the beta coefficient is the sum of the slopes in the regression of the monthly returns on a stock on the lead, the current, and the lag month's value-weighted market return.

and the test results are presented in an attempt to estimate the role of the major risk factors (variables), included in the model. Finally, in the last section conclusions are drawn.

2. Beta estimation for assets traded on the BSE-Sofia

2.1 Model structure and data used

Apart from the difficulties connected with the lack of a sufficiently reliable database on stock prices, the estimation of beta coefficients using historical data faces some statistical problems. For instance, with the so-called 'intervalling' effect, one is usually referring to the problems caused by measuring stock returns from different time intervals.[5] The basic implication of the intervalling effect is the non-synchronous bias in the estimation of market betas. The effect of non-synchronous bias is due to the fact that, because of the thin trade, stock returns are not measured from identical time intervals (for evidence when daily betas are estimated see e.g., Hawawini, 1983). Unlike other similar studies, where only monthly returns are used, this study examines betas estimated from daily, weekly and monthly return intervals. Assuming that the differences between beta estimates are entirely due to larger standard errors of the betas based on longer return intervals (in this case a month), these betas should be less related to the return variations. On the other hand, if the beta estimates based on shorter return intervals are significantly biased by infrequent trading, their ability to explain return variation will be low (for evidence see e.g., Martikainen, 1991 on Finnish data).

The beta coefficients are calculated using Sharpe's market model (Sharpe, 1964), i.e. from the following regression equation:

$$r_{i,t} = \alpha_i + \beta_i \, r_{m,t} + \varepsilon_{i,t}\,, \qquad (1)$$

where: r_{it} = excess return of stock *i* in period *t*
r_{mt} = return of market portfolio *m* in period *t*
α_i = estimated intercept term for stock *i*
β_i = estimated beta coefficient of stock *i*
ε_i = residual term (estimated unsystematic return component of stock *i* in period *t*)

5. Cohen *et al*. (1983) argued that the fundamental cause of the intervalling effect bias is the friction in the trading process which delays the adjustment of a security price to informational change, and showed how price adjustment makes security returns serially correlated and hence lead to biased estimates of the true betas.

Estimating beta from equation (1) is sensitive to the choice of appropriate market index[6] used as a proxy of the market portfolio. The study uses the value-weighted approach when computing the market index. Two market indices have been used in the empirical tests – an index that includes all stocks in the sample and an official market index. Because the official index of Bulgarian stock exchange (BSE)-Sofia was introduced for the first time in October 2000, the market index returns over the period 1998-2000 had to be additionally computed. This was done by using the prices of the same stocks that were subsequently included in the official index and weighted by the market capitalization of the companies at the moment when the stock enters the index. The study uses continuously compounded returns determined as changes in the logarithmic price indices.[7] Here prices are corrected for paid dividends, splits and new issues.

One of the most crucial aspects when measuring beta from different return intervals is that of their stability over time. A study of Dimson and Marsh (1983) indicated that betas of stocks listed on thin markets seem to be of markedly stable nature. In addition, they reported that daily returns would generate more stable beta estimates than weekly returns, and the betas based on weekly returns would be more stable than betas measures from monthly returns. Martikainen (1991), using data from the Finnish stock market, provided evidence that betas estimated from daily and weekly return intervals were found to be more stationary than betas on monthly return. A plausible explanation for this phenomenon in the economic literature is that the thin trading creates the impression of stability as regards the beta coefficients.[8] Based on these findings we expect that the results for betas estimated from shorter return intervals would be similar for stocks traded on BSE-Sofia.

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6. According to Fama and French (1996) it is possible that the apparent empirical failures of the CAPM are due to bad proxies for the market portfolio. In other words, the true market is mean-variance-efficient, but the proxies used in empirical tests are not.

7. The changes in the logarithmic price indices can be regarded as good approximations of the returns in case of thin trading. For a day with no trade, the true price is proxied by the bid quotation. When several bid prices for the same stock on the same day have occurred, the weighted average of these prices has been computed. The weekly returns are calculated using Friday-to-Friday returns. The monthly returns are calculated using differences between the closing values of price indices for each month. The returns are computed for the whole sample period from January 1998 to December 2002.

8. In addition, more stable estimates for beta can be obtained by lengthening the estimation period, i.e. by increasing the number of observations in a given return interval (see e.g., Martikainen, 1991 on Finnish data).

2.2 Empirical results and discussion

The sample data set contains 160 common stocks traded on the Bulgarian stock exchange during the sample period from January 1998 to December 2002. We apply the following two criteria for the selection of sample stocks. First, a stock must have active trading. Any stock without a trading record during the whole test period (01/2000-12/2002) is disregarded (with a few exceptions). Second, a stock should have at least 9 monthly returns in the 24-month period before January 2000. Thus, the total number of stocks, listed on the BSE-Sofia by the end of 2002, is reduced to 160 (see Appendix 1). In this way, the problem with thin trading on the Bulgarian stock exchange can be partially overcome, which is important when determining stock returns on different time intervals, especially those on daily intervals. Thus, the stock returns on daily, weekly, and monthly time intervals are computed using changes in the price indices. The obtained excess returns (over the risk-free rate of return) are then used to estimate the beta coefficients. The regression equation (1) is run for each sample stock using time-series data for the whole sample period. The estimates for betas are calculated using the OLS technique.

The results of the regressions are in line with other similar studies and indicate that beta coefficients, estimated on longer return intervals (in this case on monthly return) have higher values than betas measured from daily returns. Another interesting observation is that the average betas are clearly less than unity. This phenomenon is mainly due to the thin trading with the stocks of most of the companies included in the sample, and partially to the value-weighted market index[9] (VWI) used in the regressions. One possible explanation is that the returns of the small companies in the sample are probably less correlated with the value-weighted returns of the index (dominated by the large firms) than the returns of the large companies with the index returns. As a result the larger companies have higher beta estimates than the other companies in the sample. When the official market index (SOFIX), computed for the whole sample period, is used as a proxy of the market portfolio in equation (1), the estimated beta coefficients have lower values (compared to betas from the regressions using VWI). However, the number of the statistically significant coefficients (at the usual 5% and 10% levels) remains relatively small. This number varies from 25 (for betas estimated on weekly return intervals) to 51 (for betas estimated on daily return intervals).

9. The index includes all the 160 common stocks in the sample weighted with the market capitalization of the sample companies by the end of each time interval (day, week or month).

The basic statistical properties of the beta coefficients are reported in Table 1. The whole sample period is divided into two sub-periods: 1998-1999 and 2000-2002, because frequent trading on the BSE-Sofia is observed after May 2000. The results indicate that beta coefficients estimated for the whole sample period (5 years) are more significant than betas estimated for each of the two sub-periods (because of the smaller number of observations in the sub-periods).

Table 1. Basic statistical properties of the estimated beta coefficients for the whole sample period and sub-periods

	Mean		**Standard deviation**		**Number of negative betas**	
	VWI	SOFIX	VWI	SOFIX	VWI	SOFIX
Daily betas						
1998 - 2002	**0.1135**	**0.0264**	**0.2611**	**0.1280**	**46**	**68**
1998 - 1999	0.1395	0.0207	0.3783	0.2010	50	75
2000 - 2002	0.0892	0.0222	0.2330	0.1386	40	57
Weekly betas						
1998 - 2002	**0.1229**	**0.0299**	**0.2511**	**0.1383**	**46**	**63**
1998 - 1999	0.1657	0.0210	0.4493	0.1986	61	81
2000 - 2002	0.0861	0.0318	0.2489	0.1554	52	58
Monthly betas						
1998 - 2002	**0.1757**	**0.0898**	**0.3672**	**0.2217**	**46**	**50**
1998 - 1999	0.1549	0.0856	0.5949	0.4473	62	65
2000 - 2002	0.1565	0.0910	0.3303	0.2156	47	54

The following conclusions can be drawn from the statistics in Table 1:

1. Betas estimated on monthly return intervals have higher values than betas measured from daily and weekly returns (for both cases of regressions based on VWI and SOFIX indices). Their mean for the whole sample period is 0.1757, whereas the means of daily and weekly betas are respectively 0.1135 and 0.1229.

2. Betas based on weekly return intervals seem to be more stable within the sample, as well as over time, when compared to betas estimated on daily and monthly returns. At the same time, the monthly betas have the highest standard deviation (0.3672) compared to the daily and weekly betas – respectively 0.2611 and 0.2511. When the official index SOFIX is used in the tests instead of the value-weighted index (VWI), the daily beta estimates have the lowest standard deviation (0.1280).

3. The number of stocks with negative betas is remarkably small in the case of regressions using the value-weighted market index, VWI (46 for the whole sample, regardless of the return intervals), compared to the case of regressions based on the official index SOFIX (68 for whole sample when using daily return intervals). The main reason for negative beta estimates is the negative excess returns of most of the sample stocks over the observation period.

4. The low values of the determination coefficient, R^2 (not reported here), indicate that the market risk (beta) could account for only a small part of the variations in the stock returns, listed at the BSE-Sofia. Furthermore, the number of statistically significant betas is too small, no matter which market index is used in the model (1).

In conclusion, the results from the study of Bulgarian stock returns support the evidence that beta coefficients, estimated on daily and weekly return intervals, seem to be more stable than betas, based on monthly returns, and are consistent with the results from other countries (e.g., Martikainen, 1991 on Finnish data). This finding justifies the use of weekly betas in the following cross-sectional regressions.

3. Cross-sectional regressions and empirical results

3.1 Data and methodology used

According to the basic assumptions of CAPM, the relation between expected return and beta is linear. At the same time, some authors, among them Fama and French (1992), find out that the risk-return relationship is flat, while the combination between size (ME) and book-to-market equity (BE/ME) has a higher pricing effect in the cross-regressions of expected return.[10] According to them the two variables (size and BE/ME) are sufficient to explain the cross-variations in the average return. The study of the CAPM prediction in Bulgarian stock market gives some preliminary evidence that, despite the thin trading and impossible short sales, there is a linear positive relation between beta and expected return (e.g., Mateev, 2000). This study aims to corroborate or to repudiate these preliminary results, and to provide additional evidence on the existing CAPM anomalies in the Bulgarian stock market.

The data set includes 160 common stocks, traded on the BSE-Sofia, during the sample period from January 1998 to December 2002 (259 weeks). Relevant market data of these sample companies are compiled from the BSE-Sofia database (daily

10. Like Fama and French some other authors (e.g., Chan and Chui, 1996) find that it is not the beta, but the BE/ME variable that is statistically significant for the estimation of the average return. In addition to this they contend that there is a considerable estimated effect, caused by the dividend yield (DY) and not by the market equity (ME).

and weekly bulletins), and are used to compute the variables used in the model, namely beta (β), market equity (ME), and market indices return (VWI and SOFIX). As in most studies (e.g., Fama and French, 1992), financial institutions are excluded from this study[11] with two exceptions: The Economic and Investment Bank (EIB) and The Central Cooperative Bank (CCB). In addition, the value-weighted returns of a portfolio, including all sample stocks and the return of three-month government bonds (Treasury bills) are used as proxies respectively for the return of market portfolio and the risk-free rate of return. The returns of sample stocks and that of the market index are computed as excess return above the risk-free rate of return, and used in the two-step regression procedure, set forth below.

The research methodology follows Ho et al. (2000) and consists of four basic steps to testing the model, namely portfolios formation, post-ranking betas estimation, regression procedure of Fama and MacBeth (1973) and testing the zero hypotheses.

First, the 160 sample stocks are grouped into 16 portfolios of 8 to 11 stocks each on the basis of firm size (ME) and then beta. For this purpose, the logarithm of size as at the end of December 1999 is computed for each of the stocks as a proxy of the size (market equity). Then, the so-called 'pre-ranking' betas are estimated for the individual stocks in each group of portfolios using time-series data for 24 months or 96 weeks (01/1998 –12/1999). The 160 stocks are first ranked in an ascending order of the logarithm of size, and then sorted into four size groups (quartiles) from the smallest (ME1) to the largest (ME4) group, each of which contains 36-40 stocks. The stocks within each sub-group (size quartile) are then ranked in an ascending order of their pre-ranking beta estimates[12] (based on weekly return interval) and sorted into four risk sub-groups (quartiles) from the lowest risk ($\beta 1$) to the highest risk ($\beta 4$).

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11. There are two reasons why the financial institutions are not included in the research of Fama and French (1992). First, the majority of the book assets of most financial institutions, such as loans of commercial banks and investment portfolios held by insurance companies or investment trusts, are accounted according to their market value. Therefore, it is possible that financial ratios of these companies in which the book assets is a component, e.g. BE/ME, A/ME and A/BE, may not have the same interpretation as those of the other companies. Second, since the financial institutions typically have a higher leverage, this high level of leverage for financial companies may not have the same meaning as for non-financial companies.

12. Since the trade with some of the sample stocks, listed on the BSE-Sofia, started after the beginning of the observation period (January 1998), the number of observations of the weekly returns of these stocks, used to estimate the pre-ranking betas, varies from 12 to 103. This is another reason why monthly betas cannot be used in the study.

Thus, a total number of 16 portfolios, namely ME1/*β1*, ME1/*β2*,….., ME4/*β4*, each containing between 8 and 11 sample stocks[13], are formed (see Table 2). The portfolios are formed on size because size produces a wide spread of average returns and betas, but size and betas of portfolios (ranked on size) are highly correlated so that traditional asset pricing tests lack power to separate size from beta effects in average returns (for evidence see e.g., Chan and Chen, 1988). Therefore, the formation of portfolios on size and then pre-ranking betas allows for variations in betas that are not related to size. This makes the two-step procedure appropriate for the purposes of this study.

Table 2. Number of stocks in portfolios ranked on size and then pre-ranking betas

	beta 1	**beta 2**	**beta 3**	**beta 4**	
ME 1	8	8	8	8	33
ME 2	10	10	10	9	39
ME 3	11	11	11	10	43
ME 4	10	10	10	11	41
				Total:	156

The next step is to estimate the so-called 'post-ranking' betas for each of the 16 portfolios, grouped on size and then pre-ranking betas, using time-series data for a 154- week period (01/2000 – 12/2002). For this purpose the value-weighted returns of the 16 portfolios are computed for each week of the sample period. Then, the regression equation (1) of the weekly excess returns is run on the market index returns for the full test period to estimate the portfolio post-ranking betas. The test-period post-ranking beta estimates of a size-beta portfolio are then assigned to each stock in that portfolio.

The Fama and MacBeth (1973) cross-regressions are then run for each of the 154 weeks of the test period (01/2000 – 12/2002). The excess returns (dependent variable) of the 156 individual stocks for each of the 26 weeks from January to June of year t are regressed cross-sectionally on the explanatory variables, computed on

13. The actual number of stocks, included in the 16 size-beta portfolios, is 156 because there is no sufficient number of observations of four companies (BSH, ASTEH, ARMHL and KTEX) during the period 01/1998-12/1999, in order to estimate their pre-ranking betas. These companies were listed on the Bulgarian stock exchange considerably later than the others in the sample.

the basis of data available at the end of June of year *t - 1*. For the next 26 weeks from July to December of year t the regressions are run based on data available at the end of December of year *t - 1*.[14] This approach represents a modification of the traditional Fama and MacBeth (1973) methodology in two aspects. First, the use of full-period post-ranking betas helps minimize the 'error in the variables' problem and enhances also the precision of beta estimation. Second, the allocation of portfolio post-ranking betas to individual stocks in the portfolio makes possible the use of individual stock data rather than portfolio data in the cross-sectional regressions, thus improving the statistical power of the tests (for evidence see e.g. Ho *et al.*, 2000).

Finally, the time-series average values of the γ-coefficients from the cross-regressions are computed for the whole test period (01/2000 – 12/2002). The *t*-statistics are then calculated to test the null hypothesis that these average *γ* estimates are equal to zero, i.e. to determine whether the explanatory variables are on average priced in the marketplace.

As a result, it is possible to estimate the role of the variables in cross-sectional regressions in explaining the variations in asset returns on the Bulgarian stock market. The post-ranking betas used in the regressions are estimated based on the value-weighted index VWI and the official market index SOFIX.

3.2 Empirical tests and preliminary results

Table 3 contains the estimated values of the post-ranking betas, while Table 4 shows the average excess returns of the 16 size-beta portfolios. The statistics in Table 3 provide information on relevant features of the Bulgarian stock market. The first two have important implications for the test methodology, whereas the second two provide preliminary evidence on size and beta effects on the average return of stocks, traded on the BSE-Sofia.

First, in each group of portfolios, ranked by size, the post-ranking betas follow to a certain extent the ordering of the pre-ranking betas. This finding confirms the assumption that the post-ranking beta estimates are informative about the ordering of the true betas. This provides support to the use of post-ranking portfolio betas instead of individual stock betas in the cross-sectional regressions. It is obvious from the statistics in Table 3 that, in any size quartile, the pre-ranking betas sort

14. The gap between the financial statements data and the stock returns (in this case six months) is to ensure that the financial information for the companies, included in the sample, is made publicly available before the stock returns it is used to explain.

achieves its goal in producing strong variations in post-ranking beta estimates that are unrelated to the size.

Second, in contrast to the findings from the U.S. market (e.g., Fama and French, 1992), but consistent with evidence on the Finnish market (e.g., Martikainen, 1991) and Hong Kong market (see Ho et al., 2000), the post-ranking betas generally vary positively with the size (except for the first group ME1). This implies that stocks which form portfolios of higher size have higher beta estimates. The high correlation between the two variables (beta and size) is evidence supporting the relevance of the two-pass sort of portfolios on size and then beta in separating beta and size effects in average returns.

Table 3. Post-ranking beta estimates over the period 01/2000-12/2002

	Beta 1	**Beta 2**	**Beta 3**	**Beta 4**
ME 1	0.2219	0.2767	0.0412	-0.2254
ME 2	0.1015	0.0133	0.0341	0.0816
ME 3	0.1443*	0.4366**	0.0406	-0.0930
ME 4	0.4006*	0.3028*	0.6053*	1.1786*

* Statistically significant at 5% level
** Statistically significant at 10% level

Third, comparing the results across the size quartiles, it becomes obvious that the average excess return (see Table 4) tends to decrease with increasing size (except for the last group ME4). This is in line with the results from the Fama and MacBeth cross-sectional regressions[15] that a negative size effect exists. Another feature noticeable from the statistics is that each of the four beta portfolios in the group with the smallest size (ME1) has higher average return than the corresponding portfolios in the group with the highest size (ME4). The negative average returns of some of the 16 size-beta portfolios indicate that the prices of stocks, included in these portfolios, tend to decrease during the sample period. This phenomenon is often observed at the BSE-Sofia.

15. The evidence on UK stock returns based on 100 portfolios grouped first by size and then by pre-ranking betas, indicates that the relationship between the size of the portfolios and the average return appears U-shaped for many of the pre-ranking beta deciles (see e.g., Fletcher, 1997).

Table 4. Average weekly excess returns over the period 01/2000-12/2000

	Beta 1	Beta 2	Beta 3	Beta 4
ME 1	0.0985	0.2041	0.3362	0.8632
ME 2	0.0108	0.1324	-0.3083	0.4487
ME 3	-0.2612	-0.0607	-0.2717	-0.1074
ME 4	-0.1551	0.1622	-0.2147	-0.1636

Finally, and more important, Tables 3 and 4, together with Figure 1, provide evidence for a strong negative relation between the post-ranking betas and the average returns of the 16 size-beta portfolios over the sample period. This implies that, on average, the systematic risk might not have been priced in the Bulgarian stock market. Another interesting result from the analysis (see Table 3) is that the systematic risk might have been priced differently across companies of different size. Though the results from Fama and MacBeth regressions cannot delineate clearly this differential pricing effect across companies of different size, they do confirm the preli-

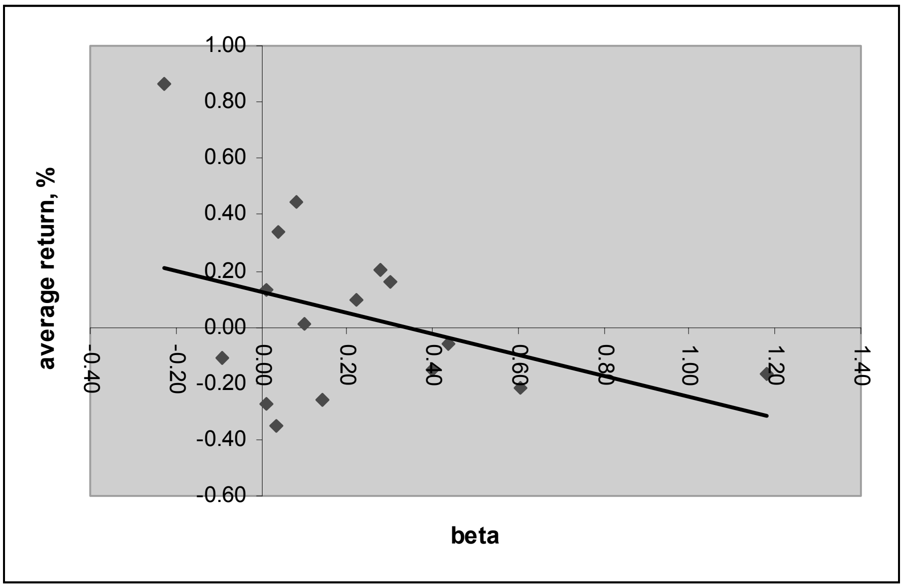

Figure 1. Post-ranking betas versus average excess returns of the size-beta sorted portfolios on the BSE-Sofia.

minary evidence from other similar works that market risk (beta) is not priced in the BSE-Sofia.[16]

3.3 Fama and MacBeth (1973) cross-sectional regression results

The model used in the empirical tests is a slightly modified version of Fama and French's (1992) cross-sectional estimation model as follows:

$$R_{i,t} = \gamma_0 + \gamma_1\beta_p + \gamma_2 \ln(ME)_{i,t-1} + \gamma_3 \ln(BE/ME)_{i,t-1} + \gamma_4 \ln(A/ME)_{i,t-1} + \gamma_5 \ln(A/BE)_{i,t-1} + \gamma_6 (P)_{i,t-1} + u_i \quad (2)$$

where: $R_{i,t}$ = excess return of stock *i* in period *t*

β_p = post-ranking beta of portfolio *p*, allocated to individual stock *i*, included in portfolio *p*

ME_{t-1} = market equity of stock *i* in period *(t - 1)*

BE/ME_{t-1} = book-to-market equity in period (*t - 1*)

A/ME_{t-1} = asset-to-market equity in period (*t - 1*)

A/BE_{t-1} = asset-to-book equity in period (*t - 1*)

$P_{i,t-1}$ = price per share of stock i in period (*t - 1*)

Each of the explanatory variables in equation (2) is taken in natural logarithm respectively of market equity, book-to-market equity, asset-to-market equity, asset-to-book equity, and price, in order to mitigate the problem of heteroscedasticity. The Fama and MacBeth (1973) cross-sectional regressions of the excess returns (dependent variable) of the 156 individual stocks in the sample are run on the explanatory variables (*β, ME, BE/ME, A/ME, A/BE* and *P*) for each week of the test period (01/2000- 12/2002).[17] The residual term in the regression (2) is the estimated unsystematic risk component of the stock returns.

Table 5 summarizes the time-series mean values of the γ-coefficients estimated from the cross-sectional regressions for full test period. The statistics in Table 5

16. It is relevant to point out that the beta estimates and the size-beta portfolio returns are computed based on publicly available data on stock prices and trade volumes on Bulgarian stock exchange for the period 1998-2002.

17. The explanatory variables in the model (2) in period *(t - 1)* are computed on the basis of financial statements data (e.g. BE, A) as at the end of the latest six-month reporting period that coincides with (*t – 1*), or market data (e.g. ME, P) as at the end of that period. In Bulgaria, financial statements data for public companies are made available within six months of the end of the reporting period (on annual or semiannual base).

provide relevant information on the role of the variables used in the model in pricing assets on the Bulgarian stock market.

First, the statistical results indicate that in both univariate regressions with beta as the only explanatory variable and multivariate regressions with beta in combination with other explanatory variables, the estimated risk premium on beta is actually negative, although significant, which suggests a downward sloping relation between beta and return (with average slope of -0.9755 when using the value-weighted market index VWI and -1.1421 when using the official market index SOFIX) (see Panels A and B of Table 5). This confirms the preliminary evidence on beta role discussed above. The result is in line with the evidence of some other studies (e.g., Fletcher, 1997 in the UK and Ho et al., 2000 in Hong Kong). However, it contradicts the results of many of the earlier works (e.g., Kothati et al., 1995), which suggest generally a positive relation between average return and beta. While the institutional and structural features of developed stock markets do contribute to the negative beta effect, the results of this study suggest that, in Bulgaria, the traditional CAPM may indeed be misspecified so that some properties of the assets cannot be priced using beta or some risks other than beta are rewarded in the Bulgarian Stock market. Some authors argue for a better applicability of the zero-beta CAPM rather than the standard CAPM (e.g., Martikainen, 1991).

Second, the data from Table 5 indicate a marginally significant size effect in the Bulgarian stock market with a positive risk premium (average slope respectively of 0.278 and 0.1966) (see Panels A and B of Table 5). The result does not depart substantially from the evidence for strong size effect in America, Hong Kong and other countries. To the extent that size reflects diversification of activities, market liquidity, timeliness and quality of corporate information, available to all investors in the market place, and level of the transactional costs, larger companies tend to have a lower risk and hence, lower return. In case of the Bulgarian capital market the size effect, however, is positive. The result is not unexpected, bearing in mind that the relation between average return and beta is negative (see Figure 1).

Third, the 'book-to-market equity' variable plays no role in explaining the cross-sectional average return. The pricing effect of ln(BE/ME) is positive but statistically insignificant in both cases of regressions (using VWI and SOFIX indices). This finding is not consistent with those found in other developed markets (e.g., Fama and French, 1992 in the USA, and Chan and Chui, 1996 in the UK), and also in some emerging markets (e.g. Ho et al., 2000 in Hong Kong). In fact, according to Chan and Chen (1991), the risk captured by BE/ME might be the relative corporate distress factor, i.e. companies that the market judges to have poor perspectives, signaled by high BE/ME ratio, have higher expected returns than companies with strong perspectives. Such evidence, however, is not found on the Bulgarian stock market.

Fourth, when the BE/ME variable is broken down into two components – market leverage (A/ME) and book leverage (A/BE) - the relation between the average return and these two variables (more precisely the logarithm of A/ME and A/BE) is significant, although negative (with average slope of –0.3960 and –0.3640) (see Panel A of Table 5). The evidence from other studies indicates that the BE/ME effect is almost entirely due to the presence of market leverage but not of book leverage. That is, the market leverage subsumes the book leverage and thus captures the whole effect of the BE/ME variable. Hence, the market leverage may have properties similar to the book leverage, as is the case with UK and Hong Kong companies.[18] This is not observed in the Bulgarian stock market as the BE/ME effect is substituted by A/ME and A/BE variables. In fact, it is the difference between market and book leverage that helps explain average returns; and the difference between the two leverage variables is equal to BE/ME, i.e. $\ln(BE/ME) = \ln(A/ME) - \ln(A/BE)$. A high BE/ME ratio indicates that a company's market leverage is high relative to its book leverage. A company has a higher degree of market-imposed leverage because the market judges that its perspectives are poor and discounts its stock prices relative to their book value.

Finally, unlike the evidence from other countries this study finds an insignificant stock price effect, with a positive risk premium (average slope between 0.0465 and 0.066). The low pricing effect of this variable can be partially accounted for by the larger transaction costs for lower priced stocks in the marketplace – commissions and bid-ask spread as a percentage of market price are negatively related to price in general. On the Bulgarian stock market the relation between average return and price is positive. This can be explained by the fact that stock price might be a proxy for company size. Table 5 indicates that the relation between average return and size on the Bulgarian stock exchange is positive too.

In conclusion, the cross-sectional regression analysis helps disclose important market variables (other than beta) that can explain the variations in the average returns on the Bulgarian stock market, when portfolio betas instead of individual stock betas are used. Such variables are ME, A/ME, and A/BE. Some other significant variables such as BE/ME and P are not priced in the marketplace. Table 6 summarizes and compares the evidence from the Bulgarian stock market and those from other markets.

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18. This might be attributed at least to the fact that certain assets of UK and Hong Kong companies have been revalued so that they are recorded in the financial statements at their market value instead of historical price (Chan and Chui, 1996 in the UK and Ho *et al*., 2000 in Hong Kong).

Table 5. Average γ-coefficients from cross-sectional regressions of excess return on beta, size, book-to-marker equity, market leverage book leverage and price for the full-test period 01/2000 - 12/2002

$$R_{i,t} = \gamma_0 + \gamma_1 \beta_p + \gamma_2 \ln(ME)_{i,t-1} + \gamma_3 \ln(BE/ME)_{i,t-1} + \gamma_4 \ln(A/ME)_{i,t-1} + \gamma_5 \ln(A/BE)_{i,t-1} + \gamma_6 \ln(P)_{i,t-1} + u_i$$

PANEL A. Average γ-estimates and value-weighted index (VWI)[a]							
	$\bar{\gamma}_0$	$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$\bar{\gamma}_5$	$\bar{\gamma}_6$
coefficients	-3.1879	-0.9755*	0.2783**	0.1443	-0.3960*	-0.3644**	0.0466
t-statistics	-1.3451	-2.1959	1.7382	1.2559	-2.8595	-1.9112	0.3837
PANEL B. Average γ-estimates and official market index (SOFIX)[b]							
	$\bar{\gamma}_0$	$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$\bar{\gamma}_5$	$\bar{\gamma}_6$
coefficients	-2.1018	-1.1421	0.1966	0.1238	-0.4060*	-0.3491**	0.0561
t-statistics	-0.8961	-1.5453	1.2538	1.0771	-2.9719	-1.8385	0.4562

[a] Panel A of Table 5 uses beta coefficients estimated on the basis of the value-weighted index (VWI) that includes all stocks in the sample

[b] Panel B of Table 5 uses beta coefficients estimated on the basis of the official market index (SOFIX) computed for the whole sample period

* Statistically significant at 5% level

** Statistically significant at 10% level

Table 6. CAPM anomalies: comparing evidence from prior studies and from this study

Explanatory variables	Relation with average return		
	Developed markets (USA, UK and Japan)	Emerging markets (Hong Kong, Korea, Malaysia, Taiwan and Thailand)	Markets in transition (Bulgaria)
β	Positive or 0	0	Negative
ME	Negative or 0	Negative or 0	Marginally positive
BE/ME	Positive	Positive or 0	0
A/ME	Positive	Positive or 0	Negative
A/BE	Negative or 0	0	Marginally negative
E/P	Positive or 0	0	n.a.
DY	Positive or 0	0	n.a.
P	Negative or 0	Negative or 0	0

The results in Table 6 indicate that the relation between average return and beta is flat for all stock markets except for Bulgaria. Still, beta plays a role in explaining average stock returns on the BSE-Sofia. On the other hand, the size effect is marginally positive in contrast to the evidence from other markets that a negative or flat relation between average return and size exists. At the same time the effect of book-to-market equity on average returns is insignificant on the Bulgarian stock market and is replaced by A/ME and A/BE variables. Finally, the stock price is found to play no role in the pricing of the Bulgarian equity stocks, a result similar to that in some other markets. The evidence on CAPM anomalies confirms the finding that the Bulgarian stock market is inefficient.

4. Conclusions

This paper examines empirically the relation between average return and beta on the Bulgarian stock market, using a sample of 160 common stocks traded on the BSE-Sofia. In the first part, the study investigates the effects of infrequent trading on systematic risk estimates, based on daily, weekly and monthly return intervals. Significant trading frequency effects on the values of beta estimates were found. These were assumed to be caused by the effects of non-synchronous trading bias when measuring stock returns from different time intervals. The non-synchronous trading leads to the underestimation of betas of infrequently traded stocks. The effect of infrequent trading was found to be strongest when daily return intervals were used in beta estimation. Concerning the stability of the beta estimates, the betas based on daily and weekly returns were found to be more stable than the betas based on monthly returns. In addition, it was found, in contrast to evidence from other countries, that beta coefficients are much less than unity. This phenomenon is mainly due to the thin trading and the value-weighted market index used in the tests.

In the second part of the study the relation between average stock return and beta, size, book-to-market equity, market leverage, book leverage and price is examined. The Fama and MacBeth cross-sectional regressions are used to explain the variations in average returns on the Bulgarian stock market, when portfolio post-ranking betas instead of individual stock betas are used in the tests. The results indicate, in contrast to the evidence from other markets, that beta, size, market and book leverages are priced on the Bulgarian stock market, whereas significant book-to-market equity and price effects are not observed in the marketplace. The variables (except beta) that are found to have a significant role in pricing the Bulgarian equity stocks might be proxies for certain firm-specific characteristics, which beta fails to capture fully, or proxies for certain risks (other than systematic risk) and costs. The observed anomalies on the BSE-Sofia imply that the traditional CAMP might be misspecified and does not correctly and adequately describe price behavior in the Bulgarian stock market, or that the market is inefficient. Further empirical work is required to examine the reasons that would explain these anomalies and to find other relevant and appropriate variables that determine the average returns on the BSE-Sofia.

Appendix 1. Number of companies included in the sample based on the frequency of trading (number of deals)

Company name	Enter date	De-listed on date	Number of deals by years				
			1998	1999	2000	2001	2002
Akcioner Favorit Holding Ltd Sofia	06/04/1999		0	85	131	129	251
Agrobiohim Ltd Stara Zagora	06/05/1998		148	30	1	3	0
Agria Ltd Plovdiv	19/05/1998		14	11	1	0	0
AKB Corporation Holding Ltd Sofia	30/10/1998		9	0	5	1	2
Albena Ltd - tourist resource Albena	31/10/1997		362	745	512	344	448
Albena Invest Holding Ltd Sofia	09/11/1998		117	530	584	521	689
Alen Mak Ltd Plovdiv	20/11/1997		88	24	3	10	31
Alkomet Ltd Shoumen	06/02/1998		145	12	11	4	9
Balkanfarma Razgrad Ltd	19/05/1998	18/10/01	228	144	122	62	0
Andela Ltd Burgas	19/10/1998		6	3	7	0	0
Antikoroza Ltd Knega	19/12/1997		0	0	0	8	19
Ariana Ltd Sofia	21/10/1997		21	43	15	11	29
Army Holding Sofia	07/12/1999		0	0	34	2	0
Asenovgrad BT Ltd Asenovgrad	28/10/1997		54	11	4	4	3
Asenova Krepost Ltd Asenovgrad	19/05/1998		42	7	13	7	16
Asansiorna Technica Ltd Dupnitza	18/02/2000		0	0	13	6	0
Balkankeramik Ltd Novi Iskar	09/04/1998		12	0	1	1	0
Balkan Ltd Lovetch	08/05/1998		15	3	0	0	66
Bulgar-Czech Invest Holding Ltd Smolian	03/04/2000		0	0	2	4	11
Belopal Ltd Beloslav /Turgovishte/	14/05/1998		2	1	1	0	1
Bentonit Ltd Kurdgali	21/09/1999		0	11	17	2	2
Mashproektengineering Ltd Stara Zagora	10/12/1998		2	11	3	4	7
Bestur Ltd Pazardjik	05/02/1998		5	19	1	0	0
Bulgarian Holding Company Ltd Sofia	08/04/1999		0	131	273	137	305
Bimas Ltd Rousse	29/04/1998		97	78	1	3	0
Biovet Ltd Peshtera	19/05/1998		199	81	112	70	380
Biser Oliva Ltd Stara Zagora	18/11/1997		1	2	3	148	7
Blagoevgrad BT Ltd Blagoevgrad	06/11/1997		317	348	214	218	303
TB Economic and Invetsment Bank Sofia	22/06/1998		40	6	4	8	2
Briz Ltd Sevlievo	06/02/1998		3	17	3	0	0
Bulgartabac Holding Ltd Sofia	21/11/1997		496	489	216	121	206
Buket Ltd Nova Zagora	05/08/1998		32	4	2	6	3
Bulgaria-K Ltd Kazanluk	31/03/1998		39	2	0	2	3
Bulgaria-29 Ltd Sofia	03/02/1998		23	26	1	124	47
Bulgarian Rose-Plovdiv Ltd Plovdiv	20/05/1998		21	22	12	99	48
Bulgarian Shugar Ltd Dolna Mitropolia	20/05/1998		17	7	4	8	7
TB Central Cooperative Bank Sofia	08/03/1999		0	116	63	112	80
Stara Planina Holding Ltd Sofia	11/03/1999		0	48	29	29	65
Dekotex Ltd Sliven	19/05/1998		70	55	3	3	7
Child World Ltd Yablanica	19/12/1997		3	1	0	6	1
Diamant Ltd Razgrad	17/06/1998		9	7	2	0	14
Dinamo Sliven Ltd	06/04/1998		34	0	20	9	1
Dobrudga Holding Ltd Dobritch	28/07/1998		57	36	18	1	0
Dobrotitza-BSK Ltd Dobritch	01/06/1998		2	10	3	1	1
Doverie United Holding Ltd Sofia	06/07/1998		904	899	797	300	488

Company name	Enter date	De-listed on date	Number of deals by years				
Drugba Ltd Plovid	07/01/1998		88	11	0	3	17
Drugba Ltd Razgrad	15/05/1998		88	38	11	2	3
Drugba Stil Ltd Varna	20/05/1998		23	16	1	0	2
Despred Ltd Sofia	04/06/1998		3	5	1	7	52
Djuni Ltd Sozopol	19/05/1998		101	20	10	10	0
Dupnitza BT Ltd Dupnitza	29/01/1998		12	2	0	1	9
DZU Ltd Stara Zagora	20/05/1998		60	31	0	1	30
Elenite Ltd Nesebar	11/06/1998		30	2	0	0	2
Elhim Iskra Ltd Pazardjik	05/12/1997		37	0	15	30	54
Elektronika Ltd Sofia	01/07/1998		1	2	3	4	7
Elkabel Ltd Sofia	12/01/1998		221	22	3	4	4
Elma Ltd Troyan	30/03/1998		79	23	5	4	1
ELPO Ltd Nikolaevo	15/05/1998		16	1	2	1	7
Sparki Eltos Ltd Lovetch	13/05/1998		72	20	3	42	71
EMKA Ltd Sevlievo	24/04/1998		15	3	4	5	6
Energy Ltd Turgovishte	05/12/1997		3	16	1	1	11
Energokabel Ltd Sofia	05/02/1998		27	4	0	8	12
Roka Bulgaria Ltd Kaspitchan	19/05/1998		126	58	42	18	28
Balkanfarma Dupnitza Ltd Dupnitza	19/05/1998	15/02/02	84	70	83	268	107
Fazan Ltd Rousse	20/05/1998		35	10	0	1	6
Formoplast Ltd Kurdgali	08/12/1997		7	0	0	3	0
Plovdiv Jurii Gagarin BT Ltd Plovdiv	19/05/1998		105	20	10	9	23
Severkoop Gumza Holding Ltd Sofia	02/03/1999		0	433	994	777	768
Garant Ltd Biala Slatina	10/03/1998		1	2	8	65	0
General Ganetzki Ltd Pleven	28/04/1998		13	0	0	7	0
Grand Hotel Varna Ltd Varna	18/06/1998		29	1	21	4	2
Tchernomorsko zlato Ltd Pomorie	19/05/1998		28	20	4	3	0
Han Asparuh Ltd Isperih	18/02/1998		37	13	15	22	12
Holding Center Ltd Stara Zagora	28/09/1999		0	2	4	36	33
Hebros-P Ltd Pazardjik	02/02/1998		3	1	34	0	0
Hidroelements and Systems Ltd Yambol	01/06/1998		22	8	4	5	8
Kostenetz-HHI Ltd Kostenetz	05/03/1998		15	5	5	0	33
Himko Ltd Vratza	03/11/1997		428	806	177	112	85
Himmash Ltd Haskovo	19/05/1998		36	9	1	5	0
Holding Sveta Sofia Ltd Sofia	15/09/1999		0	21	169	13	95
Holding Coop-South Ltd Sofia	21/04/1999		0	26	99	168	257
Industrial Holding Bulgaria Ltd Sofia	17/08/1998		52	168	298	229	435
Izgrev-66 Ltd Plovdiv	22/05/1998		5	0	1	1	34
Jiti Ltd Rousse	28/10/1997		13	21	6	32	0
Kaproni Ltd Kazanluk	18/12/1997		178	359	193	241	14
Captain Djado Nikola Ltd Gabrovo	03/06/1998		29	4	0	3	76
Paper Factory-Belovo Ltd Belovo	16/06/1998		12	10	25	9	0
Kotlostroene Ltd Sofia	16/02/1998		15	5	17	11	5
Kremikovtzi Ltd Sofia	11/11/1997		272	219	75	22	30
Krepegni Izdelia Ltd Plovdiv	03/02/1998		22	31	13	16	12
Katex Ltd Kazanluk	28/01/2000		0	0	38	24	12
Lavena Ltd Shoumen	19/12/1997		29	17	22	17	24
Investment Company "Zlaten Lev" Ltd Sofia	14/12/1998		8	556	190	306	556
Lion Ltd Gabrovo	20/05/1998		54	19	0	0	0
Lotos Ltd Troyan	22/05/1998		2	7	7	4	0

Company name	Enter date	De-listed on date	Number of deals by years				
M+S Hidravlik Ltd Kazanluk	15/12/1997		67	19	17	28	28
Medika Ltd Sandanski	06/05/1998		26	5	34	54	78
Minning and Extracting Factory Ltd Pirdop	03/11/1997		79	12	13	9	24
Mel Invest Holding Ltd Sliven	29/06/1998		235	164	65	4	5
MG Elit Holding Ltd Sofia	15/09/1998		30	26	13	30	49
Park Hotel Moskva Ltd Sofia	22/05/1998		3	19	0	22	24
Investment Company "Nadegda" Ltd Sofia	07/04/1999		0	126	38	85	52
LukOil Heftohim Ltd Burgas	19/12/1997		1 703	1740	500	834	1435
Black See Holding Ltd Burgas	11/11/1998		77	236	38	11	88
Neohim Ltd Dimitrovgrad	18/05/1998		183	8	2	15	175
Novoselska Gumza Ltd Vidin	01/06/1998		51	13	4	1	0
Ship Repairing Factory "Odesos" Ltd Varna	28/05/1998		52	1	8	20	7
Optela - Optic Technologies Ltd Plovdiv	05/06/1998		13	5	26	7	7
Orgahim Ltd Rousse	20/05/1998		100	29	4	15	36
Lead-Zinc Processing Factory Ltd Kurdgali	04/11/1997		82	31	23	22	46
Non-Ferrous Metal Processing Factory Ltd Sofia	12/05/1998		18	16	3	3	4
Pamporovo Ltd Pamporovo	29/01/1998		106	3	17	9	6
Pazardjik BT Ltd Pazardjik	30/01/1998		45	7	1	3	3
Petrol Ltd Sofia	22/05/1998		94	139	140	191	316
Sinergon Holding Ltd Sofia	29/06/1998		1 317	1857	1092	1406	1484
Pirinsko Pivo Ltd Blagoevgrad	20/05/1998		5	13	21	0	49
Petar Karaminchev Ltd Rousse	04/12/1997		78	10	1	0	2
Pleven BT Ltd Pleven	20/05/1998		37	34	0	2	2
Plovdiv BT Ltd Plovidv	28/10/1997		172	49	29	18	7
Plevensko Pivo Ltd Pleven	28/05/1998		31	7	2	4	0
Agropolihim Ltd Devnja	19/03/1998		192	19	14	17	0
Polimeri Ltd Devnja	03/11/1997		378	342	73	11	87
Programming Products and Systems Ltd Sofia	06/05/1998		39	41	10	1	0
Preslav-AN Ltd Preslav	19/03/1998		2	13	12	0	0
Best-technique TM Ltd Radomir	06/02/1998		47	13	17	6	2
Development Industrial Holding Ltd Sofia	04/01/1999		0	24	21	15	18
Record Ltd Gabrovo	03/06/1998		19	12	3	12	18
Balkankar-Record Ltd Plovdiv	22/05/1998		15	5	1	2	0
Riviera Ltd Varna	23/10/1997		31	20	14	4	5
Bulgarian Rose Ltd Karlovo	14/05/1998		136	52	2	6	8
Rozahim Ltd Gorna Oriahovitza	05/02/1998		2	0	8	25	0
Rubin Ltd Pleven	19/05/1998		16	10	2	26	39
Sinergon Tekstil Ltd Sofia	19/12/1997		12	0	5	4	171
Nord Holding Ltd Veliko Turnovo	26/05/1999		0	38	6	4	3
Sofarma Ltd Sofia	20/01/1998		404	371	132	214	610
Sheraton Sofia Balkan Ltd Sofia	12/05/1998		25	51	66	79	143
Shoumen BT Ltd Shoumen	23/01/1998		42	11	1	1	8
Skladova Technica Ltd Gorna Oriahovitza	06/02/1998		74	86	10	34	23
Sunny Beach Ltd - turist resource Sunny Beach	29/01/1998		240	118	55	203	553
Slitex Ltd Sliven	21/10/1997	29/05/00	61	6	38	0	0
Solvey Sodi Ltd Devnia	15/12/1997	22/11/01	822	1489	474	983	0
Sofia BT Ltd Sofia	24/11/1997		18	21	14	31	44
Stomana Ltd Pernik	04/02/1998		82	37	1	0	5
Sun Stara Zagora BT Ltd	26/01/1998		37	9	25	13	35

Company name	Enter date	De-listed on date	Number of deals by years				
Sviloza Ltd Svishtov	14/05/1998		51	14	0	0	11
L&C-HOLD Ltd Sofia	07/06/1999		0	68	23	32	42
Balkanfarma Troyan Ltd	21/05/1998	15/02/02	62	82	45	170	69
Tzelhart Ltd Stamboliiski	12/11/1997		57	23	2	4	3
Unipak Ltd Pavlikeni	15/01/1998		31	1	14	15	15
Vamo Ltd Varna	24/04/1998		73	4	2	10	7
Velpa-91 Ltd Stragitza	05/03/1998		11	0	0	2	0
Vidahim Ltd Vidin	30/03/1998		76	13	2	0	1
Radino Ltd Sofia	07/01/1998		29	17	8	0	0
Vinex Ltd Slavianci	19/05/1998		104	50	0	0	0
Varna Shipbuilding Ltd Varna	20/05/1998		269	100	9	0	0
Yambolen Ltd Yambol	11/03/1998		77	30	2	1	7
Golden Beach Ltd Varna	06/02/1998		283	193	246	143	267

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